Rice University
Department of Psychological Science

PSYC 480/640: Medical Human Factors Spring 2020

T-Th 9:25-10:40 SH 303

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Office Hours Tuesday 2:00-3:00 or by appointment

Required Texts:

None – Assigned readings (shown on the attached sheets) will be posted on Canvas.

Learning Outcomes: At the end of this course, students will:

1) Have a clear understanding of the fundamental concepts in medical human factors
2) Understand how human cognitive and perceptual limitations impact the practice of medicine
3) Be able to identify key design elements which make medical systems usable and unusable
4) Understand the kinds of errors that lead to patient harm and death, and how those error occur

Lecture	Week	Topic	Exercise
1	1/14	Introductions, Class logistics, and class motivations for the course	
2	1/16	Errors in Medicine: Classification and taxonomy	
3	1/21	Diagnostic errors	Exercise 1: Self Diagnosis
4	1/23	Errors in Medicine: Case studies	
5	1/28	Human Capabilities: Visual perception and medicine. Sleep deprivation *Graduate Presentation topics due*	
6	1/30	Device Design: Usable device interfaces	
7	2/4	Device design team exercise	Exercise 2: Drip dosing interface design
8	2/6	Device Design: Infusion pumps	
9	2/11	Walk up and use devices *Grad presentations 1, 2, 3, 4*	
10	2/13	***No class – Midterm Recess***	
11	2/18	Walk up and use team exercise	Exercise 3: Medical device design (team)
12	2/20	Device Design: International design for extreme environments. *Guest Lecture: Dr. Megan Heenan, Director of Technology Development, Rice360 Institute for Global Health*	

13	2/25	Design for all: International dosage guide design	Exercise 4: Dosage guide design
14	2/27	Device Design: Surgical robotics *Grad presentations 5,6*	
15	3/3	Informatics: Consumer health information acquisition	Exercise 5: Information accuracy
16	3/5	**Exam 1**	
17	3/10	Medical Care in Space *Guest Lecture: Vicky Byrne, Wyle Integrated Science and Engineering*	
18	3/12	Electronic heath records *Grad presentation 7*	
19	3/17	***No class - Spring Break***	
20	3/19	***No class - Spring Break***	
21	3/24	Simulators	Exercise 6: Surgical simulation enhancements
22	3/26	Medication: Drug delivery systems *Grad presentation 8*	
23	3/31	Medication: Prescriptions	Exercise 7: Prescription bottle design
24	4/2	Tele-medicine *Grad presentation 9*	
25	4/7	Human Factors in Surgery *Grad presentation 10*	
26	4/9	Macro-ergonomics *Grad presentation 11, 12*	
27	4/14	Emergency room medicine *Grad presentation 13*	
28	4/16	Special topics: transportation and military medicine *Grad presentation 14*	
29	4/21	Special topics: Current events	
30	4/23	**Exam 2**	

Examinations: There will be 2 examinations, but no Final Exam. The 2 exams will be closed book/closed note and may cover any of the material assigned up to that point. This includes material from any of the assigned readings, my lecture notes, class exercises and presentations that others have given. This is a reading intensive course (over 80 articles) and this material is all fair game for the exams.

Presentations: Each GRADUATE STUDENT student will be required to give one 10 minute presentation sometime in the semester on a specific medical interface that interests them. You will select a medical device or system and describe the device or system and detail its human

factors deficiencies or its superior design features. Your device will be likely drawn from the medical literature or the popular press (backed up by academic papers of course). You will also be required to make design suggestions that could have prevented the documented adverse consequences, or detail the design considerations that went into the device to eliminate these kinds of deficiencies. No report is required for this presentation, but you must supply me with a copy of the presentation material after the talk. Presentation topics are due on 1/28.

Class Exercises: Over the course of the semester I will assign 7 exercises. Some of these will be design exercises, and others will be more analytic in nature. Most of these will be started in class, but will then require some out of class work. Five of these will be individual exercises and two will be team based. There are no make-ups on these exercises. We will share and discuss these exercises in class and talk about the different solutions obtained.

Participation: A good deal of this class will entail open discussions of human factors issues of medical human factors, as well as discussions of student presentations and lab exercises. Active, thoughtful participation is expected from every student.

Evaluation:

Undergraduates:

Exam 1	30%
Exam 2	30%
In class exercises:	35% (5% each)
Participation	5%

Graduates:

Exam 1	25%
Exam 2	25%
In class exercises:	35% (5% each)
Presentation	10%
Participation	5%

Americans with Disabilities Act (ADA)
The ADA requires that all qualified persons should have equal opportunity and access to education regardless of the presence of any disabling conditions. Any student with a documented disability who needs academic accommodations should speak to me within the first two weeks of class. Students with disabilities should also contact Disability Support Services at 713-348-5841 or via their website www.dss.rice.edu.

Honor System Policy:
As with all endeavors at Rice, you are expected to adhere to the Honor Code and follow the guidelines given in the Honor System Handbook. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook at http://honor.rice.edu/honor-system-handbook/. Exams are given under the honor system. There is no make-up for exams, presentations or in-class assignments except for urgent medical situations or *pre-approved* circumstances of an exceptional nature. Students are encouraged to bring any concerns involving academic integrity to the attention of the instructor.

Syllabus Change Policy
This syllabus is only a guide for the course and is subject to change with advanced notice.

Readings for the course are listed below:

Lecture 1

- To err is human: Building a safer healthcare system: executive summary
- Institute of medicine medical error figures are not exaggerated
- Five years after To Err is Human. What have we learned?
- Ten years after to err is human
- Consumer views of hospital errors in the USA
- Human Factors myths and facts

Lecture 2

- The Causes of human error in medicine
- A cognitive taxonomy of medical errors
- Should we consider non-compliance a medical error?
- Medical errors and human factors engineering: where are we now?

Lecture 3

- Diagnostic error in internal medicine
- Diagnostic errors in three medical eras: a necropsy study
- Will you be misdiagnosed? How diagnosis errors happen
- A new Diagnosis paradigm
- AI Doctor: An intelligent approach for medical diagnosis

Lecture 4

- Set phasers on stun: Set phasers on Stun
- Preventable anesthesia mishaps: a study of human factors
- Safer technology: solutions or experiments?
- Set Phasers on Stun: Double vision
- The Atomic Chef: The Embryo Imbroglio
- The Atomic Chef: Safer than safe

Lecture 5

- Impact of extended duration shifts on medical errors, adverse events and attentional failures
- Neurobehavioral performance of residents after heavy night call vs after alcohol ingestion
- The importance of perception research in medical imaging
- Using eye movements to study visual search and improve tumor detection
- Vision enhancement system for detection of oral cavity neoplasia
- Perceptual enhancement of tumor targets in chest xray images

Lecture 6

- Injury and death associated with hospital bed side-rails
- Medical device development: the challenge for ergonomics
- Incorporating human factors into the design of medical devices (letter to the editor)
- Users as designers: how people cope with poor HCI design in computer based medical devices
- Safe medical devices for children : executive summary
- Do it by Design: an introduction to human factors in medical devices

Lecture 7

- No readings (exercise)

Lecture 8

- A usability evaluation of an infusion pump by nurses using a patient simulator
- A user centered evaluation of three intravenous infusion pumps
- Technology characteristics predicating end user acceptance of smart intravenous pumps
- Programming errors contribute to death from patient controlled analgesics case report and estimate of probability

Lecture 9

- Submaximal decision theory and health resource conservation: the example of congestive heart failure
- Wearable medical devices for tele-home health
- Learning to use a home medical device: mediating age-related differences with training
- Comparison of naive sixth-grade children with trained professionals in the use of an automated external defibrillator
- Development and Evaluation of a Just-in-Time Support System

Lecture 10

- No readings (midterm recess)

Lecture 11

- No readings (exercise)

Lecture 12

- Diagnostic lab in a backpack
- Reducing the risk of unsafe injections in immunization programmes
- Saving Newborns In Malawi With Bubble CPAP

Lecture 13

- Industrial Design and Human Factors: Design Synergy for Medical Devices

Lecture 14

- State of the art in surgical robotics: clinical applications and technology challenges
- A steady hand robotic system for microsurgical augmentation
- The effectiveness of surgical robots

Lecture 15

- Patient informatics
- Low heath literacy: what do your patients really understand
- A needs assessment for patient safety education: focusing on the nursing perspective
- The Impact of Inaccurate Internet Health Information in a Secondary School Learning Environment

Lecture 16

No readings (Exam 1)

Lecture 17

- Medical care systems for long duration space missions
- Monitoring and telemedicine support in remote environments

Lecture 18

- Electronic health records
- It ain't necessarily so: the electronic health record and the unlikely prospect of reducing health care costs
- Consumer health informatics
- Systematic review: Impact of health information technology on quality, efficiency and cost of medical care
- Human-centered computing in health information systems

Lecture 19

No readings (Spring break)

Lecture 20

No readings (Spring break)

Lecture 21

- Virtual reality in surgery
- High fidelity medical simulation in the difficult environment of a helicopter: feasibility, self-efficacy and cost
- How valid are commercially available medical simulators?

Lecture 22

- Preventing medication errors: quality chasm (executive summary)
- Improving patient safety by identifying side effects from introducing bar coding in medication administration
- Role of computerized physician order entry systems in facilitating medication errors
- Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system.

Lecture 23

- Electronic prescribing
- Technology induced error and usability: the relationship between usability problems and prescription errors when using a handheld application
- Evaluation of drug label designs using eye tracking

Lecture 24

- Using telemedicine to conduct behavioral assessments
- Telemedicine
- The tele-health promise

Lecture 25

- Human factors and safety in surgery
- Wrong site surgery
- Ergonomics in medicine and surgery
- Operating Room failures

Lecture 26

No readings

Lecture 27

- Macro-ergonomics in quality of care and patient safety

Lecture 28

- Patient safety in trauma care
- Human factors and ergonomics in the emergency department
- Human factors field study of equipment and process design and medication safety (abstract)

Lecture 29

- Ergonomic evaluation of the ambulance interior to reduce paramedic discomfort and posture stress
- Virtual reality and tele-presence for military medicine